

REMARKS

Claims 12-15 are pending in the application. Claim 12 has been amended. No new matter has been introduced.

Claim 12-15¹ are rejected under 35 U.S.C. § 103(a) as being unpatentable over Basu et al. (U.S. Patent No. 6,270,541). This rejection is respectfully traversed.

The present invention relates to a process according to which methanol with 0-20 wt.% water is introduced into a vehicle, where it is converted to dimethyl ether (DME) and water, resulting in an equilibrium mixture with 5-50 wt. % methanol left unconverted. This equilibrium mixture contains 30-68 wt. % DME and 14-40 wt. % water. The equilibrium mixture is injected into an engine of a vehicle.

Contrary to the claimed invention, Basu discloses fuel to an engine of a vehicle with 70-95 wt. % DME. Basu discloses a specific example where 94 wt. % DME, 3 wt. % water and 3 wt. % methanol is introduced into a Navistar engine equipped with an air-to-air intercooler (col. 5, lines 1 and 2) and exhaust gas recycle. Basu does not disclose, teach or suggest the purpose of heating the exhaust gas. As the combustion air to the engine is cooled by atmospheric air, which leaves the engine after cooling of combustion air, Basu does not suggest at all to use the exhaust gas for combustion air cooling.

Applicants note that, traditionally, it is disadvantageous to heat combustion air, as heated air requires more space, which results in a non-optimal use of the volume of the ignition chamber in the engine. Thus, both the fuel to the engine and the cooling/heating of air to the engine are different in Basu and in the claimed invention.

¹ Applicants note that claims 8-11 were canceled in the Amendment dated January 19, 2005, and claims 12-15 were added. Accordingly, applicant assumes that the rejection of claims 8-11 in the present Office Action was an error and that the rejection was intended to be directed to pending claims 12-15.

The engine used by Basu is a Navistar T 444 E diesel engine with turbo charger and air-to-air intercooler (col. 4, line 61 – col. 5, line 2), while the engine used in the claimed invention is a single cylinder Yanmar YDG 3000 diesel engine equipped with air heating (page 9, lines 16 and 17). Basu does not even mention combustion air heating in the Navistar engine; Basu only mentions the air intercooler.

Applicants submit that a turbocharger may compress the combustion air to a certain extent, leading to some increase in the temperature (although this increase is not wanted) and an intercooler is installed. The temperature of the exhaust gas is a result of operating conditions in the engine, and the prior art does not disclose, teach or suggest heating combustion air with exhaust gas, as it is typically regarded as disadvantageous to do so. Accordingly, it would not have been obvious to preheat the combustion air.

Basu and the claimed invention use two different engines. Additionally, Basu and the claimed invention use two different fuels. An engine with an air intercooler does not suggest preheating the combustion air, regardless of the temperature of the exhaust gas.

As noted above, Applicants submit that, conventionally, warm combustion air is regarded as disadvantageous. However, the present invention surprisingly has shown that operation of a diesel engine with a fuel being an equilibrium mixture of DME/methanol/water, and with preheating of combustion air to at least 60 °C, preferably above 100 °C, results in improved performance of the engine. This is clearly demonstrated from the test results given in table 9 in the description of the application. From this table it can be shown that:

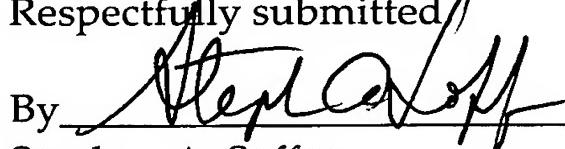
- diesel fuel results in much more NOx in the exhaust gas, than DME fuel does;
- DME fuel results in more NOx in the exhaust gas, than methanol/DME/water equilibrium mixture fuel does; and
- operation with preheated combustion air up to 120-127°C results in lower fuel consumption than operation without combustion air preheating.

This means that vehicles with methanol in a storage tank, and with conversion of methanol and preheating of combustion air according to the invention, surprisingly show an improved performance.

In view of the foregoing, the present invention, as now claimed, is deemed to be distinguishable over the cited prior art. Allowance of all pending claims is solicited.

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